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# "Selection of Behavioral Tasks & Development of Software for Evaluation of Rhesus Monkey Behavior During Spaceflight"

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Behavior & Performance Project

I. **SUMMARY OF FINDINGS**: The results of several experiments were disseminated professionally during this semiannual period. These peer-reviewed papers that were accepted for publication represent the growth of our research areas, as follow-up experiments to previously published work in cognition and enrichment have been completed and are being published. The presentations not only reflect the latest interesting results that we have obtained, but also serve as a testament to the intense interest that is being expressed for our test system and findings.

A. Washburn, D. A. (1993). The stimulus movement effect: Allocation of attention or artifact. Journal of Experimental Psychology: Animal Behavior Processes. (see appendix)

B. Washburn, D. A., & Hopkins, W. D. (1994). Videotape- versus pellet-reward preferences in joystick tasks by macaques. Perceptual and Motor Skills, 78, 48-50. (see appendix)

C. Washburn, D. A., Harper, S., & Rumbaugh, D. M. (In press). Computer-task testing in the social milieu. Primates.

Abstract

Previous research has demonstrated that a behavior and performance testing paradigm, in which rhesus monkeys (Macaca mulatta) manipulate a joystick to respond to computer-generated stimuli, provides environmental enrichment and supports the psychological well-being of captive research animals. The present study was designed to determine whether computer-task activity would be affected by pair-housing animals that had previously been tested only in their single-animal home cages. No differences were observed in productivity or performance levels as a function of housing condition, even when the animals were required to "self-identify" prior to performing each trial. The data indicate that cognitive challenge and control are as preferred by the animals as social opportunities, and that, together with comfort/health considerations, each must be addressed for the assurance of psychological well-being.

D. Rumbaugh, D. M., & Washburn, D. A. (1993). Counting by chimpanzees and ordinality judgments by macaques in video-formatted tasks. In S. T. Boysen & J. Capaldi (Eds.), The Development of Numerical Competence: Animal and Human Models (87-106). Englewood Cliffs, NJ: Erlbaum.

E. Washburn, D. A., Rumbaugh, D. M., & Putney, R. T. (In press). Apparatus as milestones in the history of comparative psychology. Behavior Research Methods, Instruments, & Computers.

Abstract
Significant apparatus developments from the history of comparative psychology are reviewed, including the contemporary trend toward computer use in research with nonhuman animals. It is argued that milestone apparatus served not only to open new lines of inquiry, but also to shape or delimit the nature of the answers that were obtained.

F. Washburn, D. A. (1993, November). Numerousness judgments by monkeys and computers. Paper presented at the meeting of the Society for Computers in Psychology, Washington, DC.

Abstract
In the present report, the processes by which monkeys solve a relative numerousness judgment task were the focus of empirical experiments and computational simulations. Several models, including associative algroithms and neural networks, were tested as computer simulations, and the output of each was compared to actual data. Each simple computational model mirrored many aspects of the animals' performance, and suggested several interesting hypotheses for future investigation; however, none fully explain all the characteristics of the monkeys' number-related cognition.

**IV. RESEARCH ACTIVITIES**: The following support studies and research-related activities were undertaken within this semiannual period.

**A. Continuation of ongoing studies.** As evidenced by our publications and presentations during this period, we have continued to test 9 GSU animals on a battery of tasks. These sessions contribute to the corpus of normative and support data required for our science. Experiments in visual search, attention scanning, short-term memory, motivation, and psychological well-being are ongoing.

**B. Testing and use of PTS software.** Careful review of PTS software functioning is ongoing. Problems identified within this semiannual period have been communicated to the Software Discrepancy Committee at ARC and have been addressed.

**C. Development of flight schedule of tasks and parameters.** The schedule of tasks projected for the flight, as well as the parametric settings for each task, were modified during this period in accordance with information gleaned during the 20-day qualification tests at ARC. We remain confident that an impressive array of task measures will avail flight data that are sensitive to even subtle alterations in performance and productivity.

**D. Effects of subclinical dosages of ethanol and diazepam.** To examine the sensitivity of task measures to subtle behavior changes, a study was conducted with $N = 6$ monkeys to determine whether performance alterations could be detected following the ingestion of small dosages of diazepam or ethanol. Dosage levels

were selected to ensure that no overt behavioral symptoms would be produced. Notwithstanding, significant alterations in performance were detected across task measures relative to baseline. Significantly more trials were completed under treatment conditions, but response times were significantly slower when ethanol or diazepam had been administered.

**E. Studies of perceptual abilities.** An experiment was conducted to examine the perceptual abilities of rhesus monkeys on a task originally designed for human subjects. The monkeys were required to match-to-sample on the basic of either global stimulus characteristics (overall appearance) or focal (feature-level) characteristics. Humans can recognize on the basis of either stimulus dimension. This experiment revealed that rhesus monkeys can also learn to match on the basis of either characteristic, and can determine on a trial-by-trial basis the appropriate dimension for responding. These data support the continuity between human and rhesus perceptual processes.

Additionally, a series of studies was performed using a new visual search task (a variation on the DETECT task). These data have consistently revealed similarities between the basic features of perception by human and rhesus monkeys. It is noteworthy that pigeons, for example, manifest quite different patterns of visual search from humans and monkeys.